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United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory



Dividends From Wood Research

Recent Publications

July through December 1982

adhesives

1. Formaldehyde Dynamic Air Contamination by Hardwood Plywood: Effects of Several Variables and Board Treatments

Myers, G. E.

Forest Prod. J. 32(4): 20-25, 1982

Formaldehyde air contamination from a urea formaldehyde-bonded plywood was measured in laboratory chambers as a function of air exchange rate, board loading, board aging, board exposure to ammonia, and board coating. Significant reductions were observed as a result of aging and of the ammonia or coating treatments.

2. Proceedings of 1980 Symposium, "Wood Adhesives—Research, Application, and Needs"

Sponsored by: USDA Forest Service, Forest Products Laboratory, and Washington State University

USDA For. Serv., For. Prod. Lab., Madison, Wis., 1982

These papers provide an overview of recent developments and current status of adhesives for wood, a background for future conferences, and an aid to improved communication and information exchange between adhesives technologists.

anatomy and properties

3. The Application of Statistics and Computing in Wood Anatomy

Burley, J. and R. B. Miller

From: "New Perspectives in Wood Anatomy," pp. 223-242, Pieter Baas, ed., Martinus Nijhoff/Dr. W. Junk, The Hague, The Netherlands, 1982

This paper reviews the statistical techniques applicable in wood anatomy and reviews the uses of computers in wood identification and collection management.

4. Effect of Moisture Content and Temperature on the Mechanical Properties of Wood: An Analysis of Immediate Effects

Gerhards, C. C.

Wood and Fiber 14(1): 4-36, 1982

The relevant studies reported in the literature on the immediate effects of moisture content and temperature on several mechanical properties of clear wood are summarized here, and recommendations are made for future research.

5. Identification of the Wood of the Soft Pines of Western North America

Kellogg, R. M., S. Rowe, R. C. Koeppen, and R. B. Miller

IAWA Bulletin 3(2): 95-101, 1982

A method is described for identifying the woods of the soft pines of western North America—western white pine, sugar pine, limber pine, and white bark pine.

6-16. Wood Anatomy of the Neotropical Sapotaceae

Kukachka, B. F.

USDA For. Serv. Res. Pap. FPL 416—FPL 426, 1982

The Sapotaceae form an important part of the ecosystem in the neotropics. Limited inventories made in the Amazon Basin indicate that this family makes up about 25% of the standing timber volume there. However, only a very small fraction is now being utilized. Better information would help utilization, especially if that information can result in clear identification. The following papers provide such information and belong to a series describing the anatomy of the secondary xylem of the neotropical Sapotaceae. All are written by the same author and published under the same general heading, "Wood Anatomy of the Neotropical Sapotaceae."

6. XXVIII. Labatia (FPL 416)

7. XXIX. Eglerodendron (FPL 417)

8. XXX. Pseudocladia (FPL 418)

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory. These publications are made available to the public to encourage private and commercial appli-

cation of Forest Service research. The Forest Products Laboratory is maintained in Madison, Wisconsin, by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of Wisconsin.

9. XXXI. Pouteria (FPL 419)
10. XXXII. Richardella (FPL 420)
11. XXXIII. Englerella (FPL 421)
12. XXXIV. Franchetella-Eremoloma (FPL 422)
13. XXXV. Urbanella (FPL 423)
14. XXXVI. Syzygiopsis (FPL 424)
15. XXXVII. Genus Novo? (FPL 425)
16. XXXVIII. Miscellaneous (FPL 426)

17. Guaiacyl and Syringyl Lignin Composition in Hardwood Cell Components

Obst, J. R.

Holzforschung 36(3): 143-152, 1982

Lignins from hardwood cell types and cell fragments were isolated and chemically and spectroscopically investigated to help determine the monomer heterogeneity.

chemistry

18. New Esterification Method for Resin Acids

Arimoto, K. and D. F. Zinkel

JAOCs 59(4): 166-168, 1982

This paper reports on the reaction of tetraalkylammonium salts of resin acids using dehydroabietic acid as the model with various alkyl polychlorides as a method for preparing new ester derivatives of resins.

19. Qualitative and Quantitative Analysis of Diterpene Resin Acids by Glass Capillary Gas-liquid Chromatography

Foster, D. O. and D. F. Zinkel

J. Chromatogr. 248: 89-98, 1982

The elution characteristics of 77 compounds on 6 liquid stationary phases are given. For most applications, a polar and nonpolar stationary phase will suffice. The reproducibility of quantitative data was obtainable by injecting large samples (over 20 ng per component) onto the column.

20. Fermentation of Xylulose to Ethanol Using Xylose Isomerase and Yeasts

Jeffries, T. W.

Biotechnol. and Bioeng. Symp. No. 11: 315-324, 1981

The author surveyed 35 organisms, predominantly yeasts, and found about 40% capable of fermenting xylulose to ethanol, though at varying rates. *C. tropicalis* was able to convert xylose directly to ethanol under aerobic conditions.

21. Formation and Action of the Ligninolytic System in Basidiomycetes

Kirk, T. K. and P. Fenn

From: Decomposer Basidiomycetes, British Mycological Society Symposium 4, Cambridge University Press, 1982

This review summarizes the understanding of lignin metabolism by basidiomycetes with an emphasis on physiological aspects and the secondary-metabolic nature of that system.

22. Adducts of Anthrahydroquinone and Anthranol with Lignin Model Quinone Methides. 1. Synthesis and Characterization

Landucci, L. L. and J. Ralph

J. Org. Chem. 47(18): 3486-3495, 1982

The generality of the adduct formed in AHQ-catalyzed delignification of wood under alkaline pulping conditions is demonstrated by the reaction of

AHQ and anthranol with a variety of lignin model quinone methides. The results of a detailed NMR examination are presented to lend support for the rather unique stereochemical conformation proposed for the adducts.

23. Chemical Linkage of Pine Polysaccharides to Lignin

Minor, J. L.

J. Wood Chem. and Technol. 2(1): 1-16, 1982

The author uses methylation analysis to investigate the bonds between lignin and the carbohydrates remaining after enzymatic hydrolysis and alkaline reduction of ball-milled loblolly pine wood and red pine compression wood.

24. Frequency and Alkali Resistance of Lignin-Carbohydrate Bonds in Wood

Obst, J. R.

Tappi 65(4): 109-112, 1982

This paper reports on the use of milled-wood enzyme lignin to investigate the nature of lignin-carbohydrate bonds in wood. A bond frequency of 0.028 per phenyl propane unit was determined.

degradation and protection*

25. Photodegradation and Photoprotection of Wood Surfaces

Chang, S.-T., D. N.-S. Hon, and W. C. Feist

Wood and Fiber 14(2): 104-117, 1982

Scanning electron microscopy is used to obtain information on the photo-induced deterioration of southern yellow pine surfaces at ultrastructural levels. The effectiveness of chromic acid and ferric chloride in protecting wood surfaces from light is evaluated.

26. Aromatic Acids Produced During Degradation of Lignin in Spruce Wood by *Phanerochaete chrysosporium*

Chen, C.-L., H.-M. Chang, and T. K. Kirk

Holzforschung 36(1): 3-9, 1982

As part of a comprehensive study of lignin degradation products, this study establishes that lignin is degraded by white-rot fungi in part via low molecular weight aromatic acids, formation of which involves C α -C β side chain cleavage with C α oxidation.

27. ¹³C NMR Spectroscopic Study of Spruce Lignin Degraded by *Phanerochaete chrysosporium*, I. New Structures

Chua, M.G.S., C.-L. Chen, H.-M. Chang, and T. K. Kirk

Holzforschung 36(4): 165-172, 1982

As part of the continuing investigation into characteristics of softwoods decayed by white-rot, this study points to C α -C β side chain cleavages, to C α -oxidations, to aromatic ring cleavage, and possibly to reductive reactions in the lignin polymer during the fungal attack.

*FPL publications dated earlier than 1976 may contain information on pesticide usage that is no longer valid. When referring to such a publication, get current information on registration status from your County Agricultural Agent or State Extension Specialist. For processes involving disposal of hazardous chemicals, appropriate state agencies should be consulted for current information on local regulations. A list of these agencies may be obtained by circling "LIST" on the order form.

28. Microbiological and Entomological Stresses on the Structural Use of Wood

DeGroot, R. C. and G. R. Esenther

From: Proc. of Symp. "Structural Use of Wood in Adverse Environments," pp. 219-245, Robert W. Meyer and Robert M. Kellogg, eds., Van Nostrand Reinhold Co., New York, 1982

In the continuing effort to improve on wood preservation methods, the authors address the impact of bacteria, fungi, and insects upon wood used or exposed in fresh water, in soil, and above ground, and identify biological criteria for the design of microorganism- and insect-resistant wood structures.

29. New Opportunities for Utilizing Chemically Treated Wood

DeGroot, R. C.

Wood and Fiber 14(3): 211-223, 1982

Present trends in use of treated wood products are examined to identify new opportunities for their use in efforts to improve utilization of the forest resource.

30. An Assessment of Climate Index in Predicting Wood Decay in Houses

DeGroot, R. C.

Durability of Building Materials 1: 169-174, 1982

In comparing mathematical models with actual wood decay in houses, the author concluded that greater precision is needed in the models before discrete zones of decay potential can be defined in building regulations.

31. Decay Capacities and Interactions between Isolates of an Unidentified Basidiomycete and *Echinodontium tinctorium* Ell. & Ev. Obtained from Suppressed Grand Fir

Eslyn, W. E. and P. E. Aho

Can. J. For. Res. 12(2): 413-416, 1982

The authors investigated the role of the most frequently isolated basidiomycete in suppressed grand firs from one location on the Malheur National Forest in Oregon. Infections of twigs with this unidentified fungus were shown to inhibit or stop invasions of *E. tinctorium*, the most common cause of decay in firs in the area studied.

32. Durability of Exterior Natural Wood Finishes in the Pacific Northwest

Feist, W. C. and E. A. Mraz

USDA For. Serv. Res. Pap. FPL 366, 1980

The authors report observations from an ongoing study, started in 1966, of three classes of natural wood finishes: transparent water-repellent preservatives, semitransparent penetrating stains, and water-soluble salts of chromium and copper as well as chromated copper arsenate. The finishes have been applied to three wood species and exposed to the mild, moist climate of Olympia, Wash.

33. Weathering Characteristics of Finished Wood-based Panel Products

Feist, W. C.

J. Coatings Technol. 54(686): 43-50, 1982

As a basis for future more detailed studies, several top-quality finish systems were exposed outdoors on four different wood-based panel products and one solid wood substrate. Enhanced protection was found with two- and three-coat finish systems.

34. Weathering of Wood in Structural Uses

Feist, W. C.

From: Proc. of Symp. "Structural Use of Wood in Adverse Environments," pp. 156-178, R. W. Meyer and R. M. Kellogg, eds., Van Nostrand Reinhold Co., New York, 1982

The chapter discusses agents of deterioration, their effects on the physical and chemical properties of wood in various forms, and the functions and characteristics of paints, stains, and varnishes used to protect wood.

35. Ultraviolet Degradation and Accelerated Weathering of Chemically Modified Wood

Feist, W. C. and R. M. Rowell

From: Proc. of ACS Symp. "Graft Copolymerization of Lignocellulosic Fibers," pp. 349-370, D. N.-S. Hon, ed., Series 187, American Chemical Society, Washington, D.C., 1982

Various treatments for reducing the degradative effects of ultraviolet light on wood were tested, and results showed widely varying degrees of effectiveness. Treatments reported are cell wall chemical modification, polymer lumen-fill, and a combination of these two.

36. Comparison of Wood Preservatives in Stake Tests (1981 Progress Report)

Gjovik, L. R. and D. I. Gutzmer

USDA For. Serv. Res. Note FPL-01, 1981

This report updates test stake results primarily from southern pine sapwood treated by pressure and nonpressure processes and installed in test sites at various times since 1938 in Mississippi, Wisconsin, Louisiana, Florida, and Panama.

37. Influence of Type and Amount of Lignin on Decay by *Coriolus versicolor*

Highley, T. L.

Can. J. For. Res. 12(2): 435-438, 1982

To shed further light on the role of lignin in decay of wood by white-rot fungi, the author compares the decay of Ceibo wood by *C. versicolor* with decay of more typical hardwoods and softwoods. Results show that the type of lignin is more a factor in the slower rate of *C. versicolor* decay of softwoods than is the amount of lignin, or the anatomical structure of the wood itself.

38. Properties of a Carbohydrate-degrading Enzyme Complex from the Brown-rot Fungus *Poria placenta*

Highley, T. L. and K. E. Wolter

Material und Organismen 17(2): 127-134, 1982

Features of this possibly multifunctional enzyme complex isolated from *P. placenta* are described, including the effects of several agents on its activity; substrate specificity; depolymerization reactions on cellulose and xylan; and amino acid composition.

39. Participation of Singlet Oxygen in the Photodegradation of Wood Surfaces

Hon D. N.-S., S.-T. Chang, and W. C. Feist

Wood Sci. Technol. 16: 193-201, 1982

Findings imply the participation of singlet oxygen and hydroperoxide in the roughening of wood product surfaces. The authors propose a theory to explain how they are formed.

40. Bonding of Isocyanates to Wood

Rowell, R. M. and W. D. Ellis

From: Proc. of ACS Symp. "Urethane Chemistry and Applications," pp. 263-284, N. Edwards, ed., Series 172, American Chemical Society, Washington, D.C., 1982

The authors investigate the physical and chemical changes of wood when methyl, ethyl, propyl, and butyl isocyanates are bonded to it. Test results show these chemicals impart good decay resistance at weight gains above about 20%.

41. Degradation of Lignin in Birch Wood by the White-rot Fungus, *Phanerochaete chrysosporium*

Tai, D., M. Terazawa, V.-B. Huynh, C.-L. Chen, H.-M. Chang, and T. K. Kirk

From: Proc. of the Technical Association of the Pulp and Paper Industry, 1982 Research and Development Division Conference, pp. 263-272, TAPPI Press, Atlanta, Ga., 1982.

Several common reactions are characterized in part of a continuing investigation into the degradation of lignin in birch wood by *Phanerochaete chrysosporium*.

design data

42. Wood Joist Floors: Probabilistic Analysis of Joist Stiffness Measured at Retail Lumberyards

Galligan, W. L., J. H. Haskell, J. F. Senft, W. L. Ethington, J. F. Sedransk, and D. A. Fergus

USDA For. Serv. Res. Pap. FPL 402, 1982

A systematic sampling of joist lumber was conducted at retail lumberyards over two summers to observe and measure physical and mechanical properties close to point of purchase and use. This paper discusses the philosophy that prompted the study and presents the results in a probability format.

43. Effects of Knots on Stress Waves in Lumber

Gerhards, C. C.

USDA For. Serv. Res. Pap. FPL 384, 1982

In this study, an impact stress wave was induced in the end of 2×6 lumber with knots. Stress wave modulus of elasticity (ESW) calculated from the data tended to be lowest with the average timing method. All ESW's were higher than static bending modulus of elasticity; however, the values of the two types of moduli tended to approach each other as the effect of knots was removed.

44. The Effect of Geometry on the Performance of Structural Finger-joints

Jokerst, R. W.

From: Production, Marketing and Use of Finger-jointed Sawnwood: Proceedings of an International Seminar Organized by the Timber Committee of the United Nations Economic Commission for Europe, pp. 170-180, 1982

The author proposes that the key to good finger-joint performance is the geometry of the joint, which is a function of four interdependent elements: slope, pitch, finger length, and tip thickness. Ways to manipulate these elements to maximize strength are discussed.

45. Properties of Parallel-laminated Veneer From Stress-wave-tested Veneers

Jung, J.

Forest Prod. J. 32(7): 30-35, 1982

This study investigates the structural performance and predictability that can be expected from parallel-laminated-veneer members constructed from veneers segregated into stress-wave-predicted performance groups.

46. Exposure Effects Upon Performance of Laminated Veneer Lumber and Glulam Materials

Laufenberg, T. O.

Forest Prod. J. 32(5): 42-48, 1982

The author conducted a study of the deterioration of Douglas-fir laminated veneer lumber (LVL) and solid-sawn glulam specimens following accelerated exposure to simulate severe service conditions. LVL was judged to be the more stable.

47. Standards for Wood Pole Testing and Use

Moody, R. C.

From: Proc. of the Seventh Wood Pole Institute, pp. 27-38, C. E. Shuler, comp., Colorado State Univ., Ft. Collins, Colo., 1981

The author reviews nationally recognized standards for testing and using wood poles, and how results of pole tests have been incorporated into the present standard for utility poles. He also suggests some improvements for the standards.

48. Structural Performance Targets for Light-frame Wood Wall and Floor Systems

Moody, R. C.

From: Proc. of the Third ASTM/CIB/RILEM Symp., "Performance Concept in Building," Vol. 1, pp. 149-159, Laboratorio Nacional de Engenharia Civil, Lisbon, Portugal, 1982

Data characterizing the distribution of bending strength and stiffness of wall studs and floor joists, and new analysis procedures, are described. Their use in establishing realistic performance for revised design criteria is presented.

49. Strength of Lumber Under Combined Bending and Compression

Zahn, J. J.

USDA For. Serv. Res. Pap. FPL 391, 1982

Extensive tests of western hemlock 2×6 's under eccentric axial load showed that the addition of a small compressive force might increase bending strength. Test members were short, but length effect was studied analytically by simulating long members with a finite element computer model that accurately reproduced the mean but underestimated the variance.

50. How the Environment Affects Lumber Design: Assessments and Recommendations

Proceedings of a workshop sponsored by the Society of Wood Science and Technology, the Forest Products Laboratory, and the Mississippi Forest Products Utilization Laboratory (Madison, Wis., May 28-30, 1980).

USDA For. Serv., For. Prod. Lab., Madison, Wis., 1982

The workshop theme was the structural use of wood in adverse environments. State-of-knowledge summaries and reports on current research focus on the importance of both the processing and use environments. (Limited quantity available.)

fire

51. Heat Release Rates of Assemblies

Chamberlain, D. A. and J. J. Brenden

From: Proc. of Symp. "Residential Fires and Wood Product Use," pp. 22-23, E. L. Schaffer, comp., Society of Wood Science and Technology, Madison, Wis., 1980

This report traces the development of methods to determine the heat release rate (HRR) for small-scale samples and large-scale assemblies of materials. This background is then applied to the problem of determining the HRR of full-scale construction assemblies during exposure to the ASTM E 119-78 test method.

52. Redrying Fire-retardant-treated Structural Plywood

Lee, P. W. and E. L. Schaffer

Wood and Fiber 14(3): 178-199, 1982

This study examined the effects on plywood quality following redrying after fire-retardant treatment using increasingly higher temperature drying regimes. Results of different redrying processes for several fire-retardant-treatment chemicals are compared.

53. Mathematical Model to Describe the Propagation of Smoldering in Cellulosic Insulation

LeVan, S. and E. L. Schaffer

From: Proc. of the International Conf. on Thermal Insulation, Vol. 4, pp. 1-14, 1982

A mathematical model is developed to predict weight loss of cellulosic insulation under smoldering combustion, and smoldering wave-front velocity is identified as a sensitive parameter for quantifying the effects of fire retardants on this material.

54. Predicting Weight Loss from Smoldering Combustion in Cellulosic Insulation

LeVan, S. and E. L. Schaffer

J. Thermal Insulation 5(Apr.): 229-244, 1982

Based on the preceding publication, this paper presents the same mathematical model to describe the propagation of smoldering in cellulosic insulation.

55. Influence of Heat on the Longitudinal Creep of Dry Douglas-fir

Schaffer, E. L.

From: Structural Use of Wood in Adverse Environments, pp. 20-52, R. W. Meyer and R. M. Kellogg, eds., Van Nostrand Reinhold Co., New York, 1982

To aid in the design of structural timber members to sustain load during fire, the author investigates the tensile and compressive time-dependent parallel-to-grain deformation response of bone-dry coast Douglas-fir.

56. Risk-based Fire Endurance Analyses of Members and Assemblies

Schaffer, E. L.

From: Proc. of Symp. "Residential Fires and Wood Product Use," pp. 34-41, E. L. Schaffer, comp., Society of Wood Science and Technology, Madison, Wis., 1980

In light of changes being proposed to assess fire safety based on the risk of barrier failure involved, this paper presents the shortcomings of past assessment methods and the advantages of new methods that account for variability in fire exposure and loaded assembly or member behavior.

57. Effect of Calcium Silicate Substrate on Thermal Barrier Fire Testing

White, R. H.

Forest Prod. J. 32(7): 25-27, 1982

In response to a recent revision of the ICBO building code specifying the use of a calcium silicate substrate in fire testing of thermal barriers for foam plastics, the author evaluated the heat transmission performance of 5/8-inch-thick plywood and 1/2-inch-thick gypsum panels backed up with calcium silicate board.

58. Wood-based Paneling as Thermal Barriers

White, R. H.

USDA For. Serv. Res. Pap. FPL 408, 1982

To help answer inquiries from those interested in using wood-based panels for interior use, the author conducted fire penetration tests on different wood-based panel types and thickness to determine their effect in protecting insulation in fire-exposed wall assemblies.

general

59. Response of International Donors to Forestry Problems in Developing Countries

Christophersen, K. A., H. E. Wahlgren, J. L. Whitmore, J. I. Zerbe, and J. F. Landrie

J. Forestry 80(4): 235-238 & 254, 1982

This article discusses major findings of a 1979 study funded by the U.S. Agency for International Development (AID) on ongoing and proposed forestry activities in developing countries, particularly those efforts to solve problems related to reforestation.

60. Investment Analysis Programs

Harpole, G. B.

From: Proc. of Symp. "Process Control in the Forest Products Industry," pp. 19-21, Society of Wood Science and Technology, Madison, Wis., 1982

This paper describes and announces the public availability of four computer programs designed for analysis of investment problems in wood products manufacturing: Particleboard Variable Cost Program, Cash Flow Computer Program, Computer Program for Evaluating Investments in Forest Products Industries, and Fuel Economic Program.

61. Investment Evaluation: How to Look at Cost and Payback

Harpole, G.

From: Proc. of Symp. "Manufacturing Lumber from Small Logs," pp. 146-149, Ed Williston, ed., College of Forest Resources, University of Washington, Seattle, Wash., 1982

The author explains how sawmill owners can figure payback time on sawmill improvement programs. Payback time is expressed in ratio to the useful economic life of an investment. This value is used as the criterion for setting investment priorities.

62. 1982 World Wood Review—USA

Howard, J. L.

World Wood 23(5): 26-27, 1982

An overview of the decreased production levels of the forest products industries since 1980 is presented along with more optimistic predictions of near future levels.

63. Forest Products Research—An Endowment

Marra, G. G.

Forest Prod. J. 32(10): 9-14, 1982

In this keynote speech presented at the Forest Products Research Society's (FPRS) 36th Annual Meeting, the author detailed the role of research in expanding our forest resources and described how early contributions to research endowment continue to pay dividends, and why the endowment must continue to grow.

64. Trends in Economic Scarcity of U.S. Timber Commodities

Skog, K. and C. Risbrudt

USDA For. Serv. Res. Bull. FPL-11, 1982

This paper presents information on changes in real prices of timber commodities as potential indicators of economic scarcity. Data show most real prices were constant or slightly increased after World War II, with more rapid increase since 1961 followed by decreases between 1979 and 1980.

65. Every Age, the Age of Wood

Youngs, R. L.

Interdisciplnry. Sci. Reviews 7(3): 211-219, 1982

Man's manifold uses of wood, from biblical times to modern computer applications, are highlighted here. The author, the Director of FPL, predicts wood will always be valued as a major renewable resource.

66. Substitution and/or Increased Utilization Technology

Youngs, R. L.

From: Increasing Forest Productivity, Proceedings of the 1981 Convention of the Society of American Foresters, SAF Publication 32-01, 1982

The author predicts increased demand for wood along with other materials and energy resources. He concludes that more knowledge of wood and wood processing will also mean more efficient utilization of wood.

mycology

67. New Species of Corticiaceae (Basidiomycotina, Aphyllophorales) from Arizona

Burdsall, H. H., Jr. and R. L. Gilbertson

Mycotaxon 15: 333-340, 1982

Five new species of Corticiaceae from southern Arizona—*Botryohypochnus verrucisporus*, *Erythricium chapparralus*, *Laetisaris agavei*, *Trechispora sphaerocystis*, and *T. variseptata*—are described and illustrated.

68. The Genus *Tomentellastrum* (Aphyllophorales, Thelephoraceae s. str.) Larsen, M. J. Nova Hedw. 35: 1-16, 1981

A synopsis of genus *Tomentellastrum* is presented including a key to the recognized species, photomicrographs of basidiospores, and data on substratum relationships and distributions. One new combination is made, *Tomentellastrum badium* (Link per Steudal) M. Lars.

69. N₂ Fixation in Brown-rotted Soil Wood in an Intermountain Cedar-Hemlock Ecosystem

Larsen, M. J., M. F. Jurgensen, and A. E. Harvey

Forest Sci. 28(2): 292-296, 1982

The authors evaluated the importance of N₂ fixation in brown cubical decayed wood as an integral part of soil profiles in a highly productive ecosystem of the northern Rocky Mountains.

70. Cultivation of Shiitake, the Japanese Forest Mushroom, on Logs: A Potential Industry for the United States

Leatham, G. F.

Forest Prod. J. 32(8): 29-35, 1982

The history of shiitake cultivation in Japan, a description of the food value of shiitake, and information on how to cultivate the mushroom on logs in the U.S. are presented.

71. Species of *Phlebia* Section *Leptocystidiophlebia* (Aphyllophorales, Corticiaceae) in North America

Nakasone, K. K., H. H. Burdsall, Jr., and L. A. Noll

Mycotaxon 14(1): 3-12, 1982

Species limits of three North American species of *Phlebia* section *Leptocystidiophlebia* are clarified using cultural and morphological data. The species are *Phlebia ludoviciana*, proposed as a new combination, *P. subochracea*, and *P. subserialis*. *P. brevispora*, a related species, is also discussed.

72. Three Brown-rot Fungi in the Corticiaceae

Nakasone, K. K. and R. L. Gilbertson

Mycologia 74(4): 599-606, 1982

Crustoderma resinosum and two new species, *Crustoderma flavescens* and *C. opuntiae*, are described and illustrated.

73. Nitrogen-fixing Bacteria in Douglas-fir Residue Decayed by *Fomitopsis pinicola*

Spano, S. D., M. F. Jurgensen, M. J. Larsen, and A. E. Harvey

Plant and Soil 68: 117-123, 1982

The authors measured nitrogen-fixing bacteria in various decay stages of Douglas-fir logs infested with *Fomitopsis pinicola*. Results showed numbers

of nitrogen-fixers and N-fixation rates in the wood increased as decay progressed, an effect that apparently is related to increases in wood moisture content.

packaging

74. Recycled Fibers in Corrugated Fiberboard Containers

Fahey, D. J. and D. W. Bornmett

Tappi 65(10): 107-110, 1982

Reductions in strength that occur in the recycling of clean corrugated fiberboard are traced to the drying of the components and the ratio of kraft pulp to NSSC pulp in the components. The authors suggest further study of the contaminants in used corrugated board and the ways to remove them.

75. Method Analyzes Analogue Plots of Paperboard Stress-Strain Data

Urbanik, T. J.

Tappi 65(4): 104-108, 1982

To aid in analyzing paperboard stress-strain data and identifying factors affecting curve shape and ultimately box performance, this report provides guidelines for objectively deducing an average curve from a set of curves.

processing

—drying
—sawing
—grading

76. Machine Stress Rating of Wood: An Overview

Bendtsen, B. A. and R. L. Youngs

From: Proc. of XVII IUFRO World Congress, Division 5, pp. 21-34, IUFRO, Rome, 1981

The authors review the three basic principles of machine stress rating—prediction of strength through nondestructive parameters, assignment of allowable design stresses, and quality control—particularly as they are practiced in the U.S. and Canada. Nondestructive predictors of strength other than those currently used are also discussed, along with some advantages of MSR with reference to visual grading of lumber.

77. A Checklist for Drying Small Amounts of Lumber

Bois, P. J., E. M. Wengert, and R. S. Boone

USDA For. Serv. For. Prod. Util. Tech. Rep. 6, Revised 1982

This list of 11 procedures developed by the Forest Products Lab and State and Private Forestry can help those people who dry small amounts of lumber to eliminate loss from drying degrade.

78. OPTYLD—A Multiple Rip-first Computer Program to Maximize Cutting Yields

Giese, P. J. and K. A. McDonald

USDA For. Serv. Res. Pap. FPL 412, 1982

This paper describes OPTYLD, a computer program useful in softwood moulding and millwork operations for studying yield of individual boards, yield of board grades and grade mixes, effects of alternative rip widths on yield, effects of defect scanning equipment, and effects of alternative cutting bills.

79. Capacitive In-kiln Wood Moisture Content Monitors: Principles of Operation and Use

James, W. L. and R. S. Boone

Wood Sci. 14(4): 146-164, 1982

The authors concluded from this study of the basic principles governing the operation of capacitance-type kiln monitors that the monitors can provide useful information as long as extraneous variables such as temperature and moisture distribution are considered.

80. Using Speed of Sound in Wood to Monitor Drying in a Kiln

James, W. L., R. S. Boone, and W. L. Galligan

Forest Prod. J. 32(9):27-34, 1982

This study shows speed of ultrasonic pulses through specimens of lumber being dried in a kiln correlates with changes in moisture content of the wood. This means speed of sound could be used to monitor drying progress.

81. Some General Characteristics of Capacitive In-kiln Moisture Monitors

James, W. L. and R. S. Boone

Forest Prod. J. 32(4): 57, 1982

The authors present a brief summary of an FPL study to help clarify some of the basic principles involved in in-kiln monitoring of the moisture content of lumber loads using the capacitance method.

82. Manufacturing Quality Structural Lumber from Hardwoods Using the Saw-Dry-Rip Process

Maeglin, R. R. and R. S. Boone

From: Proc. of Ninth Annual Hardwood Symposium of the Hardwood Research Council, pp. 29-45, USDA For. Serv. NE For. Exp. Stn., Broomall, Pa., 1981

Aspen, sycamore, cottonwood, and blackgum-sweetgum 2 × 4's were produced by conventional method and by a new method called S-D-R which includes the use of high temperature drying. The characteristics and reject rates of lumber produced by both methods are compared and adaptation of S-D-R to mills and its probable usefulness in the housing industry are presented.

83. Maintaining Lumber Quality in Rapid Drying Systems by Manipulating Sawing Patterns

Simpson, W. T.

From: Proc. of 3rd International Drying Symposium, Vol. 2, pp. 202-211, J. C. Ashworth, ed., [University of Birmingham, England, 1982]

This paper reports on a rapid press drying technique for lumber that helps eliminate internal cracks that often develop during drying. The process is based on quartersawing boards.

84. Warp Reduction in Kiln-drying Hardwood Dimension

Simpson, W. T.

Forest Prod. J. 32(5): 29-32, 1982

A restraining device to reduce warp in kiln-drying hardwood dimension was designed and tested on hardwood at varying levels of restraining force. Cup and bow were not reduced, but twist was reduced by 25% to 50%, and crook was reduced by up to 35%.

85. Characteristics for Presorting White Fir Lumber With Wetwood

Ward, J. C. and D. Shedd

From: Proc. of 1981 Annual Meeting of Western Dry Kiln Clubs, pp. 32-41, School of Forestry, Oregon State University, Corvallis, Oreg., 1981

The authors have determined wetwood characteristics of white fir that could be used for a more objective method of presorting at high-production lumber mills, and have outlined steps for a commercial presorting system.

86. Bacterial Oak and How to Dry It

Ward, J. C.

Southern Lumberman 243(3017): 8-10, 1982

The author suggests four different drying techniques for reducing volume losses with bacterial oak and discusses possibilities for developing a feasible presorting system.

pulp and paper

87. Fungal Treatment Can Reduce Energy Requirements for Secondary Refining of TMP

Bar-Lev, S. S., T. K. Kirk, and H.-M. Chang

Tappi 65(10): 111-113, 1982

This paper reports on the pretreatment of a coarse thermomechanical pulp from red alder with the ligninolytic fungus *Phanerochaete chrysosporium*. The treatment substantially reduced the energy required in secondary refining yet did not diminish strength properties when glucose was added. Results suggest further study.

88. Bonding of Air-laid Webs: Critical Amount of Moisture Necessary

Byrd, V. L.

Tappi 65(5): 153-155, 1982

This study showed that 40% added moisture is sufficient to develop interfiber bonding in air-laid sheets that are press-dried, and that wet-web densification followed by conventional air-drying cannot produce the high strength levels obtainable by press-drying.

89. The MyCoR Process for Color Removal from Bleach Plant Effluent: Bench Scale Studies

Campbell, A. G., E. D. Gerrard, T. W. Joyce, H.-M. Chang, and T. K. Kirk

From: Proc. of the Technical Association of the Pulp and Paper Industry, 1982 Research and Development Division Conference, pp. 209-214. TAPPI Press, Atlanta, Ga., 1982

Bench scale studies of MyCoR, a biological process for removing the undesirable color from pulp and paper mill discharge, show color reductions of up to 80% in 2-day batch reactors.

90. The Role of Web Properties in Water Removal by Wet Pressing: Characterization of Dewatering Time Constant

Caulfield, D. F., T. L. Young, and T. H. Wegner

Tappi 65(2): 65-69, 1982

The interaction of viscous and compressive properties of the wet mat establishes a dewatering time constant that predicts the dewatering behavior of the mat. Relating this constant to the wet press nip residence time can be useful in optimizing process parameters to achieve energy efficiency.

91. Method Obtains Fungal Reduction of the Color of Extraction-stage Kraft Bleach Effluents

Eaton, D. C., H.-M. Chang, T. W. Joyce, T. W. Jeffries, and T. K. Kirk

Tappi 65(6): 89-92, 1982

The authors investigated the use of cellulose-containing primary sludges from integrated pulp and paper mills as the growth substrate for ligninolytic fungi used for decolorization. Evaluated are biological and chemical oxygen demands, color, and the efficacy of a rotating biological contactor.

92. Kraft Bleach Plant Effluent Can Be Decolorized Using the Synergistic Effects of Cations Solubilized by Acidification of Waste Sludge

Eaton, D. C., H.-M. Chang, and T. K. Kirk

Tappi 65(5): 167-170, 1982

Sludges from integrated kraft pulp and paper mills were used to remove color from the E₁-stage effluent produced during chlorine bleaching. Based on this research, the authors propose that decolorization of effluent by acidified sludge has potential as a rapid and effective process.

93. Alkaline Pulping in Aqueous Alcohols and Amines

Green, J. and N. Sanyer

Tappi 65(5): 133-137, 1982

In adding alcohols and amines during alkaline pulping, the authors observed that pulps from low amine charges had higher tear values than kraft pulps but had lower burst and tensile strengths. At high amine levels the alkali requirement was substantially reduced but the cellulose viscosity and pulp mechanical properties deteriorated.

94. Pulp

Minor, J.

From: Kirk-Othmer: Encyclopedia of Chemical Technology, Vol. 19, pp. 379-420, John Wiley & Sons, Inc., New York, 1982

The author presents a semitechnical, detailed explanation of pulp—what it is, where it comes from, how it can be made, and what it can be used for.

95. Improve Strength in High-yield Pulps Through Chemical Treatment

Wegner, T. H.

Tappi 65(8): 103-107, 1982

This study shows that strength of high-yield aspen thermomechanical pulp was improved with a mild treatment of sodium hydroxide or sodium sulfite/sodium carbonate in conjunction with thermomechanical pulping.

96. New Press Drying Process Increases Freeness, Yield

Wegner, T. H., R. A. Horn, and M. R. Rosenthal

Southern Pulp and Paper 45(4): 26-29, 1982

This study examines key process variables—including yield, freeness, chip washing between cooking and fiberizing, and fiberizing conditions—involved in producing high-yield, high-freeness hardwood pulps for use in the new press-drying papermaking process.

residues and energy

97. A Wood and Bark Fuel Economics Computer Program (FEP)

Harpole, G. B., P. J. Ince, J. L. Tschernitz, and E. Bilek

USDA For. Serv. Res. Pap. FPL 415, 1982

The wood and bark fuel economics computer program described here aims to provide a means to assess the relative energy values of wood and bark for use as fuel. It can make pre-engineering assessments of the economics involved in modification of wood/bark fuel systems.

98. Energy and Chemicals From Wood

Rowell, R. M., G. J. Hajny, and R. A. Young

From: Introduction to Forest Science, pp. 451-469, Part 4, Chapter 19, R. A. Young, ed., John Wiley & Sons, Inc., New York, 1982

The authors review several alternatives to energy problems in the United States. The use of biomass, particularly wood biomass, as a source of energy, liquid fuels, and chemicals is discussed.

99. Changes in Aspen Bark Stored in Outdoor Piles

Zoch, L. L., Jr., J. J. Rusch, and E. L. Springer

Forest Prod. J. 32(6): 31-34, 1982

The authors examined the storage characteristics of aspen bark stored outdoors by determining bark substance losses at several locations in the storage piles. Internal pile temperatures, moisture and ash contents, and pH before and after storage are reported.

wood materials

100. Powered Back-up Roll—New Technology for Peeling Veneer

Froneczak, F. J. and S. P. Loehnertz

USDA For. Serv. Res. Pap. FPL 428, 1982

101. Influence of Chuck Design on Spin-out Torque in Softwood Veneer Peeling Blocks

Froneczak, F. J. and R. A. Patzer

USDA For. Serv. Res. Pap. FPL 427, 1982

These papers are the first two in a series of four that describe the FPL powered back-up roll (PBR), which was designed and built to provide auxiliary torque to a veneer bolt. The first paper reports on study results showing that chucks with slender spurs transmitted greater torque before spinning out than did chucks with thick spurs, and maximum torque increased with depth of spur penetration. Thus, properly designed chucks could reduce spin-out rate at a minimal cost. The second paper describes the development and testing of the powered PBR. Results obtained thus far show this new technology can increase product recovery and save money. The last two papers, which will be available in the next "Dividends," review laboratory and industrial performance of the PBR.

102. Feasibility of Producing Reconstituted Railroad Ties on a Commercial Scale

Geimer, R. L.

USDA For. Serv. Res. Pap. FPL 411, 1982

Based on FPL research, the Potlatch pilot plant, Lewiston, Idaho, made 11 full-sized railroad ties by laminating high-density flakeboard made from old tie material. This report describes material preparation, manufacturing procedures, and test results for the reconstituted ties.

103. Design and Construction of Large-scale Reconstituted Wood Roof Decking

Geimer, R. L., W. L. Hoover, and M. O. Hunt

Department of Forestry and Natural Resources, Agricultural Experiment Station Research Bull. 973, Purdue University, West Lafayette, Ind., 1982

The authors report on a program they initiated to design, construct, and test full-scale roof decking panels made of reconstituted wood. Panel tests showed that bending stiffness properties were adequate but that interlaminar shear strength and bending strength retention following accelerated aging may limit design.

104. Automation of a Laboratory Particleboard Press

Geimer, R. L., G. H. Stevens, and R. E. Kinney

Forest Prod. J. 32(4): 34-36, 1982

This note describes the FPL-designed, fully automated, programmable electronic equipment and associated data collection instrumentation installed on a previously manually operated particleboard press.

105. Dimensional Stability of Flakeboards as Affected by Board Specific Gravity and Flake Alignment

Geimer, R. L.

Forest Prod. J. 32(8): 44-52, 1982

The author outlines the extent to which the variables of specific gravity and flake alignment affect the dimensional stability properties of thickness swelling and linear expansion, and the associated water adsorption at various levels of relative humidity and absorption following a vacuum-pressure soak treatment.

106. Nondestructive Evaluation of Mechanical Properties of a Structural Flakeboard Made from Forest Residues

Gerhards, C. C. and L. H. Floeter

USDA For. Serv. Res. Pap. FPL 414, 1982

Full-size structural flakeboard panels made from forest logging residues, and subpanels and small specimens cut from some of these panels, were subjected to several nondestructive tests including 2 different types of stress waves. Results should interest standards-writing committees and particleboard material scientists.

107. Creep of Thick Structural Flakeboards in Constant and Cyclic Humidity

McNatt, J. D. and M. O. Hunt

Forest Prod. J. 32(5): 49-54, 1982

Creep tests were conducted on three-layer flakeboards with random core and aligned flakes and on plywood panels to determine the suitability of the thick flakeboard as roof decking for commercial and industrial buildings.

108. Response of Experimental Hardboard Dimensions and Weight to Cyclic Relative Humidity

Myers, Gary C.

Forest Prod. J. 32(7): 41-44, 1982

Results of studies of 43 different hardboards showed that each one expanded and contracted differently in response to cyclic relative humidity. Data from the first adsorption cycle were insufficient to explain some of the bulging or seam-gapping problems in use. A pattern for potential permanent dimensional change was apparent in most boards after three cycles.

109. Reconstituted Processes and Products for the 1990's

Youngquist, J. A.

From: Proc. of Ninth Annual Hardwood Symposium of the Hardwood Research Council, pp. 99-112, USDA For. Serv. NE For. Exp. Stn., Broomall, Pa., 1981

The author looks into the future of reconstituted wood products and what technological innovations will be available in this area.

cooperative research

Listed below are recent publications from universities or others involved in cooperative research with the Forest Products Laboratory. Copies are not available from the Laboratory, but may be obtained from the contacts listed following each publication.

Strength Tests of Timber Piling

Stark, C. F. (Masters Thesis)

University of Colorado, Department of Civil, Environmental, and Architectural Engineering, Boulder, CO 80309

The Importance of Starch as an Organic Contaminant on Drainage and Retention: Board Mill Systems

Springer, A. M., S. Chandrasekaran, and T. M. Wegner

From: Proc. of 1982 TAPPI Pulping Conference, TAPPI Press, P.O. Box 105113, Atlanta, GA

Lignin. 19. Kraft Lignin Component Conformation and Associated Complex Configuration in Aqueous Alkaline Solution

Sarkanen, S.

University of Washington, Department of Chemical Engineering, Seattle, WA 98195

Characteristics of Combined Effluent Treatment Sludges from Several Types of Pulp and Paper Mills

McGovern, J. N., J. G. Berbee, J. G. Backheim, and A. J. Baker

From: Proc. of 1982 TAPPI Environmental Conference, TAPPI Press, P.O. Box 105113, Atlanta, GA

Redox Chemistry of the 3,5-Di-*tert*-butylcatecholato and *o*-Semiquinonato Complexes of Transition Metal Ions in Aprotic Media

Chin, D.-H., S. E. Jones, L. E. Leon, P. Bosserman, M. D. Stallings, and D. T. Sawyer

In: Electrochemical and Spectrochemical Studies of Biological Redox Components, K. M. Kadish, ed., Adv. Chem. Ser. 201:657-707, 1982 D. T. Sawyer, University of California, Department of Chemistry, Riverside, CA 92521

Compression Losses in Hot Pressed Plywood

Wellons, J. D., R. L. Krahmer, M. D. Sandoe, and R. Jokerst

Plywood Research Foundation, P.O. Box 11700, Tacoma, WA 98411

Wood as a Structural Material

Dietz, A.G.H., E. L. Schaffer, and D. S. Gromala, eds.

A compilation of eight educational modules prepared for civil engineers and architects at the Second Clark C. Heritage Memorial Workshop on Wood, Madison, Wis., August 1980. \$16 per copy. Make check payable to The Pennsylvania State University, EMMSE Coordinator, 110 Materials Research Laboratory, The Pennsylvania State University, University Park, PA 16802.

The following publications are available from the Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705, U.S.A. (minimum \$5 order)

Wood-stud Walls, Stiffness of Joints between Studs and Hardwood Paneling

Polensek, A. and K. M. Bastendorff

Forest Prod. J. 32(7): 51-53, 1982, Reprint No. 6358 (\$2 plus 10% postage and handling)

Wood-stud Walls: Structural Properties of Stuccoed Sheathing

Polensek, A. and K. M. Bastendorff

Forest Prod. J. 32(4): 54-56, 1982, Reprint No. 6310 (\$2 plus 10% postage and handling)

Effect of Construction Variables on Performance of Wood-stud Walls

Polensek, A.

Forest Prod. J. 32(5): 37-41, 1982, Reprint No. 6333 (\$2 plus 10% postage and handling)

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9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104
105	106	107	108	109			LIST

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